

SPACE ACTIVITY AND THE FUTURE OF CITY M.Thangavelu¹, D.Cong², C.Derman³, M.B.Gamble⁴, Y.Godhani⁵, A.S.Kantak⁶, S.Lee⁷, V.G.Lahoti⁸, W.Lin⁹, S.Nashine¹⁰, C.A.Reonisto¹¹, J.Rutledge¹², ¹Conductor, ASTE527 Space Concept Studio, Department of Astronautical Engineering & Lecturer & Graduate Thesis Adviser School of Architecture and ²⁻¹²Graduate Student Arch599 Graduate Space Architecture Seminar, the School of Architecture, University of Southern California, Los Angeles, California 90089 mthangav@usc.edu



Introduction: As the Smart City paradigm takes hold across new metropolises and potential human habitation zones around the globe, human space activity continues to pioneer innovation in agile, responsive building systems and their evolution, transforming habitats and surroundings to suit needs of occupants as well as adapting to both dynamic and gradual changes with minimal imposition on the natural environment that we call ecological footprint. Frugal use and recycling of consumables like air and water, performant building materials, energy efficiency and systems that respond with agility to environmental changes are hallmarks of human spacecraft and mission management.

The International Space Station (ISS) is a fine example of a unique, off-the-grid Earth orbiting dwelling, that has been orbiting the Earth for nearly 20 years in the extreme environment of space, primarily dependent on solar power. For the past decade the ISS has also been recycling more than 90% of water used by her occupants. A crew of six continue to spend an inordinate amount of time on housekeeping functions. Ways to reduce crew time for facility maintenance, without impacting productivity or sacrificing safety have become a top priority.

Extending our reach into space, a lunar orbiting station is being developed by NASA with another advanced layer of efficient systems to cope with this crew time consuming deficiency. It is called system autonomy. Several parallels exist between the Smart City tenets and space system autonomy. How to preserve sense of place and enhance quality of life in cities that are rapidly evolving to absorb the migration of rural

population? Space activity & technologies hold clues that offer solutions to Future City needs & development.

Space activity informs. It lays out, in stark contrast, graphic images of the state of our biosphere, majestic and pristine portraits of nature, as it is as well as humanity's forays, and warns us about the consequences of climate change, all in real time. Human space activity in particular reminds us of our species fragility and the ecological balance necessary to sustain life. It is global in scope by necessity, cosmopolitan in nature by design, and inspires diverse communities, transcending geographic, national and economic boundaries, to address issues, anticipate problems and work together to preserve and protect our environment. Human space activity makes us more aware of our surroundings and refines our sensitivities. As global population grows, so does the need for more resources and their efficient management. By applying useful and appropriate technologies and processes of current and proposed human space activities, it is possible to create more synergetic relationships between the manmade and natural environments using principles of human space activity as a guide. Studies from the 2019 Spring USC Graduate Architecture seminar will show how our cosmopolitan cities, urban and suburban landscapes and dwellings are already using space assets including crew on orbiting space stations and allied technologies to monitor, inform and enhance quality of life. Orbiting spacecraft also help predict, alert and even prevent hazards, both natural and manmade, from affecting populations adversely. Future cities and their amenities including active adaptive and agile response systems are presented.